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Low Pass Filter and High Pass Filter Using CCII

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Abstract

The Current conveyors are unity-gain active building blocks that offer exceptionally high linearity and a wide dynamic, which makes them ideally suited for modern analog signal-processing applications where precision and bandwidth are critical [1]. They operate on low supply voltage and consume less power, which makes them suitable for integrated and low-power systems [1]. They posses high input impedance, low output impedance, high CMRR and fast slew rate, enabling efficient and accurate signal processing [1]. Today various current conveyors are available as ICs built using both BJT and MOS technologies, giving designers flexibility for different performance needs. This paper explains and demonstrates the implementation of low-pass and high-pass filters using AD844 IC. It also highlights the optimized scalability and superior performance achieved. The authors have simulated above configuration using CMOS technology and the results are also tabulated for comparison.

Keywords: AD844; High-pass filter; Low-pass filter

How to Cite This Article

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Introduction

The AD844 is a high-speed, low-power current feedback operational amplifier commonly used in analog signal processing. With its very high slew rate, wide bandwidth, and stability at high frequencies, it significantly differs from standard voltage-feedback op-amps. This device has the voltage and current terminals separated, which makes it appropriate for active filters, integrators, differentiators, video amplifiers, and data acquisition systems. The AD844 settles fast, exhibits low distortion, and hence is widely used in communication and instrumentation circuits dealing with precise signal conditioning. Low Pass Filters (LPFs) and High Pass Filters are elementary circuits utilized in the modification of which parts of a signal get through. An LPF allows low-frequency signals to pass and reduces higher ones, which helps in eliminating noise or making smoother signals. An HPF does just the opposite: it allows high-frequency signals to pass and blocks the lower ones; hence, it helps clear unwanted low, steady signals or noise. The circuits of LPF and HPF using the AD844 provide better frequency response, higher bandwidth, and other performances, especially for high-frequency applications. Therefore, the current-feedback architecture of the AD844 offers stability and accuracy in filtering, making it suitable for high-speed analog filtering applications

Literature Review

Second-generation current conveyors (CCII/CC11) based on current-mode signal processing has made a significant impression on the field of analog circuit design due to features like broad bandwidth, advanced linearity, and minimal power dissipation. Unlike typical operational-amplier filter designs, CCII-based filters are free from drawbacks like a restricted gain-bandwidth product and the slew rate limitation. This has led to a vast amount of research and development of LPF and HPF circuits based on the active component CCII for high-frequency and low-voltage operation.

The works on the realization of first-order LPF and HPF filters, second-order LPF filters, as well as HPF filters employing CCII with reduced passive components have been presented. The proposed solutions involve the use of grounded components, which can be effectively utilized during the integrated circuit manufacturing process. The use of CCII in designing LPF filters has been reported to deliver improved frequency stability. The HPF filters employing CCII also demonstrate improved high-frequency characteristics.

CCII has also been used for tunable LPF and HPF configurations in which the cutoff frequency is able to be electronically tuned via a bias current or an external resistance. Such tunability is highly desirable for adaptive signal processing and communication systems. Several comparisons available in the literature show that lower power dissipation and higher dynamic range in CCII-based filters than their classical op-amp-based counterparts make them an alternative suitable for portable and battery-operated devices.

More recent publications highlight the single-input multifunction filter designs using CCII where LPF and HPF responses can be obtained from the same circuit topology by selecting different output nodes. Such CCII-based multifunction filters decrease hardware complexity and chip area. Simulation and experimental results reported show that CCII provides superior performance in bandwidth, linearity, and noise immunity.

The survey on the literature above shows that LPF/HPF implementation employing a CCII (CC11) is an efficient technique in modern analog filtering. The continuous efforts being made in this field aim at minimizing the circuit components, improving the tuning ability, along with reducing compatibility issues with integrated circuits, thereby establishing the important role of CCII filters in advanced technology.

Simulation Analysis

Pins Of AD844-

• Pin1-Inverting current input
• Pin2-Non-inverting voltage input
• Pin3-Inverting voltage input
• Pin4-Negative supply
• Pin5-Non-inverting current input
• Pin6-Impedance output
• Pin7-NC offset trim
• Pin8-Positive voltage supply

Low Pass Filter and High Pass Filter Using CCII

Low Pass Filter-

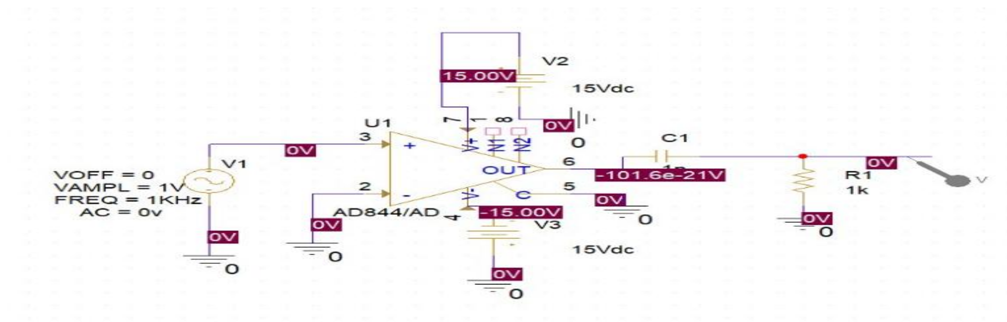

Fig. 1. *Circut Of Low-pass Filter Using IC AD844*

Connections-

• Pin1-Inverting current input
• Pin2-Non-inverting voltage input
• Pin3-Inverting voltage input
• Pin4-Negative supply- -15V
• Pin5-Non-inverting current input connected to GND
• Pin6-Output taken at capacitor(1pf) end with resistor(1k) connected at parallel
• Pin7-NC offset trim - +15V
• Pin8-Positive voltage supply

$$V_X=V_Y$$

$$I_Y=0$$

$$I_X=+I_Z$$

$$\text{Capacitor current, } I_C=C\frac{dvo}{dt}$$

$$\text{Resistor current} = \frac{Vo}{R}=\frac{Vin-Vo}{R}$$

KCL at output,

$$I_C = I_R$$

$$C\frac{dvo}{dt}=\frac{Vin-Vo}{R}$$

$$RC\frac{dvo}{dt}=Vin-Vo$$

$$RC\frac{dvo}{dt}+Vo=Vin\rightarrow Time\ domain$$

- Input I_R is used to charge and discharge capacitor.
- Low frequency, capacitor charge easily, output follows input
- High frequency, capacitor needs large current, signal is attenuated.

High Pass Filter-

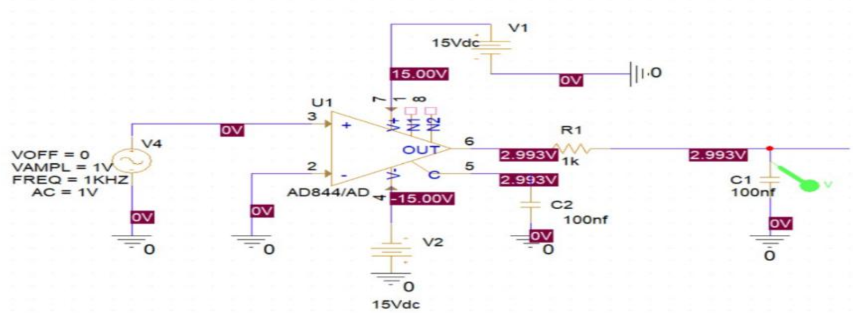

Fig. 2. *Circut Of High-pass Filter Using IC AD844*

Connections-

• Pin1-Inverting current input
• Pin2-Non-inverting voltage input
• Pin3-Inverting voltage input
• Pin4-Negative supply- -15V
• Pin5- Non-inverting current input connected to capacitor(100nf)
• Pin6- Output taken at resistor(1k) end with capacitor(100nf) connected at parallel
• Pin7-NC offset trim - +15V
• Pin8-Positive voltage supply

$$V_X=V_Y$$
$$I_Y=0$$
$$I_X=+I_Z$$
$$\text{Capacitor current, } I_C=C\,\frac{\mathrm{d}(Vin-Vo)}{dt}$$
$$\text{Resistor current } = \frac{Vo}{R}=I_R$$
$$\text{KCL at output,}$$
$$I_C = I_R$$
$$C\,\frac{\mathrm{d}(Vin-Vo)}{dt}=\frac{Vo}{R}$$
$$C\,\frac{\mathrm{dVin}}{dt}=\frac{Vo}{R}+C\,\frac{dVo}{dt}$$
$$\frac{dVo}{dt}+\frac{Vo}{RC}=\frac{dVin}{dt} \rightarrow Time\ domain$$

- Fluctuating input can supply I to R through C
- Low frequency, capacitor blocks I , Output =0
- High frequency capacitor allows I , R develops voltage

Result

Result of Low pass filter

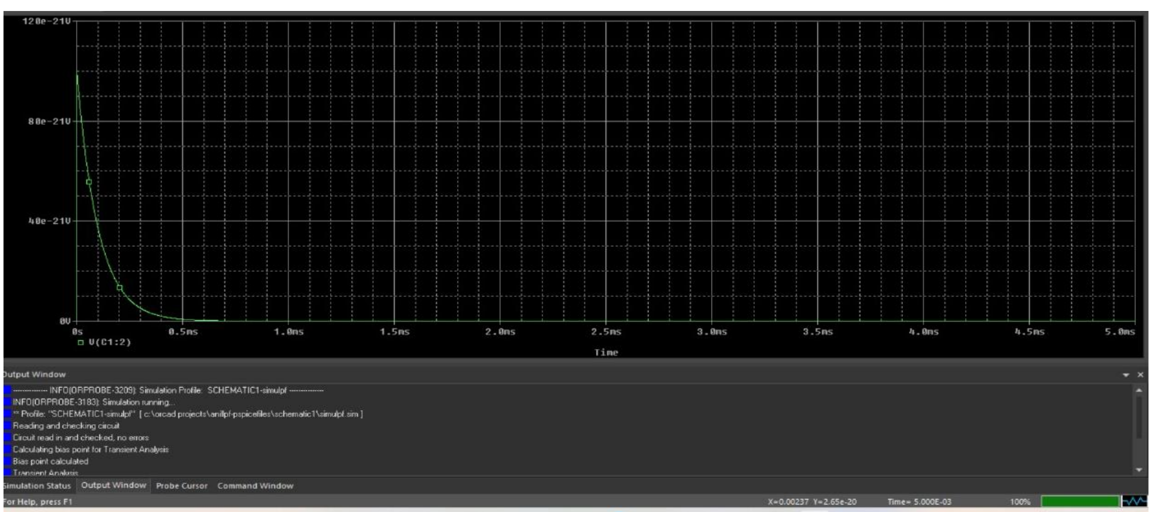

Fig. 3. *Transient Analysis of Low-pass Filter*

The above graph depicts the transient response of the low-pass filter using the AD844 op-amp when the step signal is given to the circuit. First, the output takes an analog change due to the behavior of the capacitor, which does not allow the voltage to change abruptly. At this point, the circuit allows the low-frequency signals to pass, while the signals with high frequency are blocked. Over time, the circuit shows a smooth response to the inputs, which satisfies the behavior of the low-pass filter circuit in various applications.

Result of high pass filter

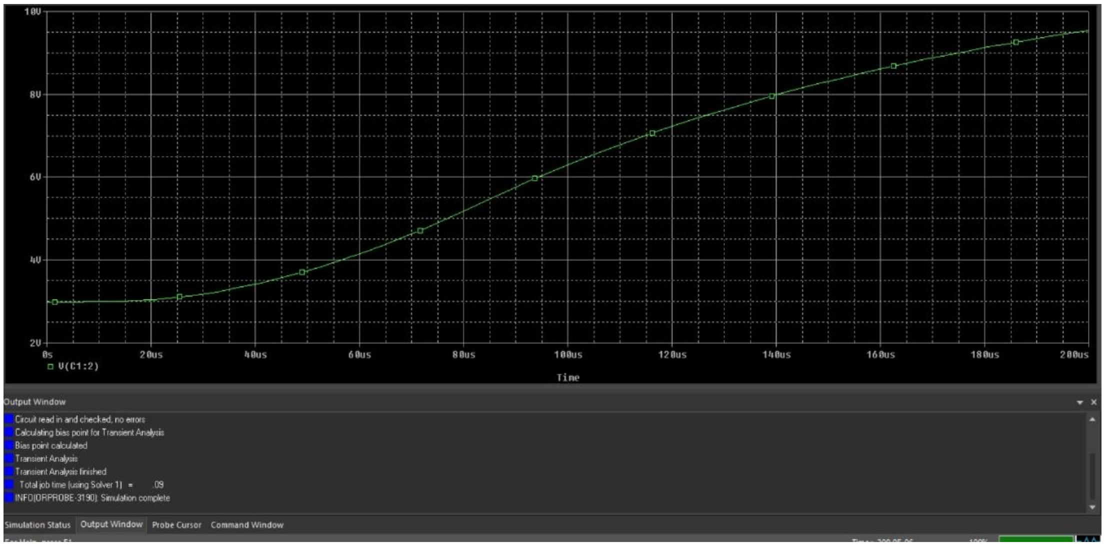

Fig. 4. *Transient Analysis of High-pass Filter*

The graph shows the transient response of a high-pass filter. At first, the output voltage is low because the capacitor blocks DC and low-frequency parts of the input signal. As time goes on, the capacitor begins to allow quick voltage changes to pass, which relate to high-frequency components. Because of the RC time constant in the circuit, the output voltage slowly rises and reaches a higher value. This upward trend shows that high-frequency signals pass through effectively while low-frequency signals are reduced. Therefore, the graph confirms that the high-pass filter works correctly in the time domain.

Future scope

The future of low-pass filter (LPF) and high-pass filter (HPF) circuits using a second-generation current conveyor (CCII) looks bright. This is due to the growing need for high-speed, low-power analog signal processing. CCII-based LPF and HPF offer wide bandwidth, better linearity, and higher slew rate compared to traditional op-amp-based filters. This makes them ideal for high-frequency and RF applications.

In the future, these filters will find many uses in integrated communication systems, biomedical signal conditioning, and sensor interface circuits, where compact size and low power consumption are essential. With improvements in CMOS technology, CCII-based filters can be effectively integrated into system-on-chip (SoC) designs. This integration will support portable and wearable electronic devices.

Moreover, their current-mode operation provides better noise immunity and easier adjustment of cutoff frequency. These befits make CCII-based LPF and HPF circuits very suitable for next-generation analog and mixed-signal systems.

Reference

1. Design and Applications of CMOS Current Conveyors by David Moro Frías.
2. A. H. Madian et al. (2006): Designed low-voltage CMOS CCII for filter applications.
3. H. M. Hassan & A. M. Soliman (2006): Proposed accurate wideband CCII circuits.
4. W. S. Hassanein et al. (2005): Reviewed CMOS CCII structures and implementations.
5. M. Kumar et al. (2010): Implemented multifunction filters using CCII.
6. R. Prokop (2009): Discussed versatility of current-mode circuits with CCII.
7. A. Sedra and K. C. Smith (1970): A Second-Generation Current Conveyor and its Applications, IEEE Transactions on Circuit Theory.
8. A. S. Sedra & K. C. Smith (2015): Microelectronic Circuits, 7th Edition, Oxford University Press.
9. Shenoi, B. A. (2005): Introduction to Signal Processing and Filter Design, Wiley.
10. Rolf Schaumann, Mac Van Valkenburg (2001): Design of Analog Filters, Oxford University Press.
11. Huelsman, L. P. (1993): Active and Passive Analog Filter Design, McGraw-Hill.
12. Oppenheim, A. V., Willsky, A. S., & Nawab, S.: Signals and Systems, 2nd Edition, Prentice Hall.